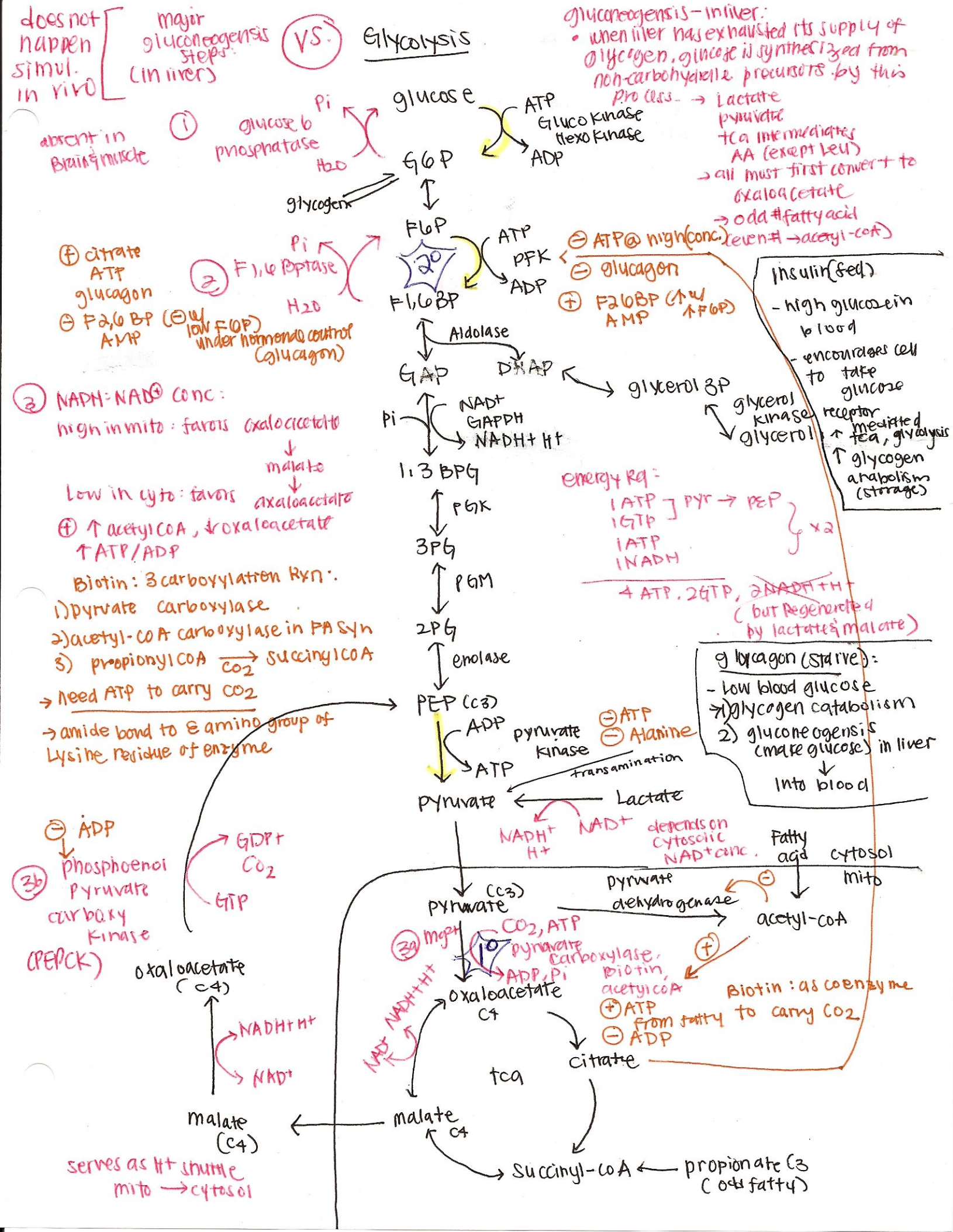
does not happen simul. in vitro
major gluconeogenesis steps (in liver)
VS.
Glycolysis
gluconeogenesis - in liver:
• when liver has exhausted its supply of glycogen, glucose is synthesized from non-carbohydrate precursors by this process → lactate, pyruvate, tca intermediates, AA (except Leu)
→ all must first convert to oxaloacetate
→ odd # fatty acid → acetyl-CoA
→ even # → acetyl-CoA)
glucose
ATP
Gluco kinase
Hexo kinase
ADP
G6P
glucose 6 phosphatase
Pi
H2O
absent in Brain & muscle
glycogen
F6P
ATP
PFK
ADP
F1,6BP
F1,6 phosphatase
Pi
H2O
⊖ ATP @ high (conc.)
⊖ glucagon
⊕ F2,6BP (↑ w ↑ F6P)
AMP
⊕ citrate
ATP
glucagon
⊖ F2,6 BP (⊖ w low F6P)
AMP
under hormonal control (glucagon)
Aldolase
GAP
DHAP
glycerol 3P
glycerol kinase
glycerol
Pi
NAD+
GAPDH
NADH + H+
1,3 BPG
PGK
3PG
PGM
2PG
enolase
PEP (C3)
ADP
ATP
pyruvate kinase
⊖ ATP
⊖ Alanine
transamination
pyruvate
Lactate
NADH + H+
NAD+
depends on cytosolic NAD+ conc.
Fatty acid
cytosol
mito
pyruvate (C3)
pyruvate dehydrogenase
⊖
acetyl-CoA
⊕
Biotin: as coenzyme to carry CO2
CO2, ATP
pyruvate carboxylase, Biotin, acetyl CoA
ADP, Pi
oxaloacetate C4
NADH + H+
NAD+
⊕ ATP
⊖ ADP
citrate
tca
malate C4
oxaloacetate (C4)
NADH + H+
NAD+
malate (C4)
serves as H+ shuttle mito → cytosol
Succinyl-CoA
propionate (C3 (odd fatty)
⊖ ADP
phosphoenol pyruvate carboxy kinase (PEPCK)
GDP + CO2
GTP
→ need ATP to carry CO2
→ amide bond to ε amino group of Lysine residue of enzyme
② NADH : NAD+ conc:
high in mito: favors oxaloacetate → malate
Low in cyto: favors malate → oxaloacetate
⊕ ↑ acetyl CoA, ↓ oxaloacetate
↑ ATP/ADP
Biotin: 3 carboxylation Rxn:
1) pyruvate carboxylase
2) acetyl-CoA carboxylase in FA syn
3) propionyl CoA → (CO2) → succinyl CoA
Insulin (fed)
- high glucose in blood
- encourages cell to take glucose
receptor mediated
↑ tca, glycolysis
↑ glycogen anabolism (storage)
energy Rq:
1 ATP
1 GTP
1 ATP
1 NADH
x2
4 ATP, 2 GTP, 2 NADH + H+
(but Regenerated by lactate & malate)
glucagon (starve):
- Low blood glucose
→ 1) glycogen catabolism
2) gluconeogenesis (make glucose) in liver
→ into blood